MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

DCT5016 – CIRCUIT THEORY

(Diploma in Electronic Engineering)

6 MARCH 2020
3.00 p.m – 5.00 p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **4** printed pages excluding the cover page with **4** questions.
2. Answer **ALL** questions. All necessary working steps must be shown.
3. Please write all your answers in the answer booklet provided.

QUESTION 1 (25 MARKS)

a) A 48-W light bulb is connected to a 240-V supply. Determine:
   i. The current flowing in the bulb.
   (2 marks)
   ii. The resistance of the bulb.
   (2 marks)

b) Use Kirchhoff's current law to find currents I_2, I_4 and I_5 in **Figure Q1.1**.
   (6 marks)

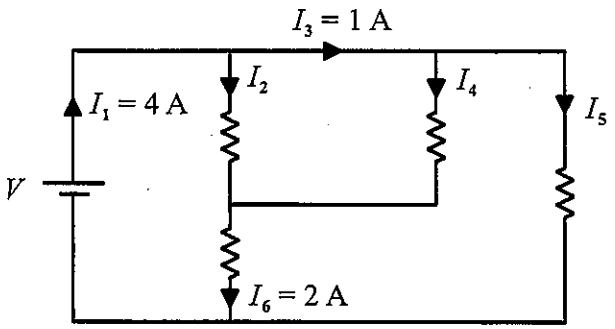

Figure Q1.1

c) Based on circuit in **Figure Q1.2**, find:
   i. Total resistance of the circuit, R_T.
   (8 marks)
   ii. Total current, I_T.
   (2 marks)
   iii. Current flowing through R_4 by using current divider.
   (2 marks)
   iv. Voltage across R_5 by using voltage divider.
   (3 marks)

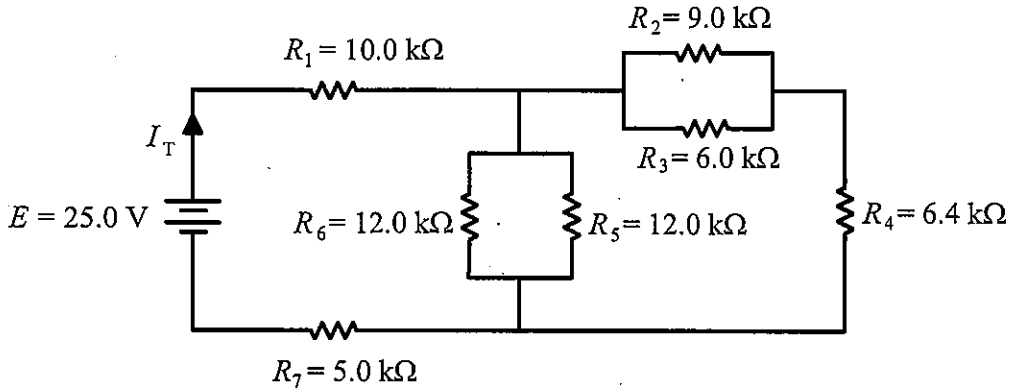

Figure Q1.2

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QUESTION 2 (25 MARKS)

a) Refer to circuit in **Figure Q2.1**.

i. Write the mesh equations for loops *abhga*, *bcdhb* and *ghdefg*.

(3 marks)

ii. Based on part (i), determine I_A, I_B and I_C. Hence, find the current flowing through R_5.

(5 marks)

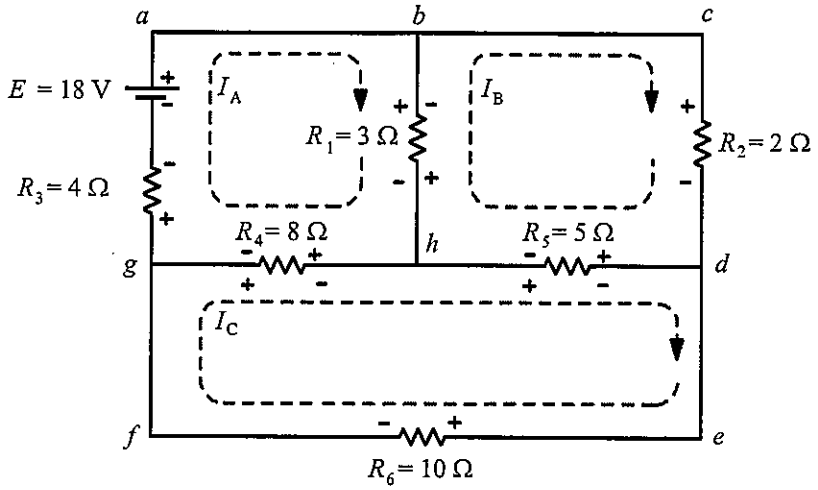

Figure Q2.1

b) Use Thevenin's Theorem to calculate the value of load resistance R_L in **Figure Q2.2** that gives maximum power dissipation and find the value of the maximum power.

(9 marks)

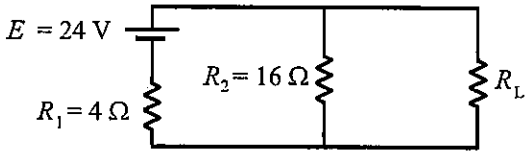

Figure Q2.2

c) Solve for V_1 in the circuit of **Figure Q2.3** using nodal analysis.

(8 marks)

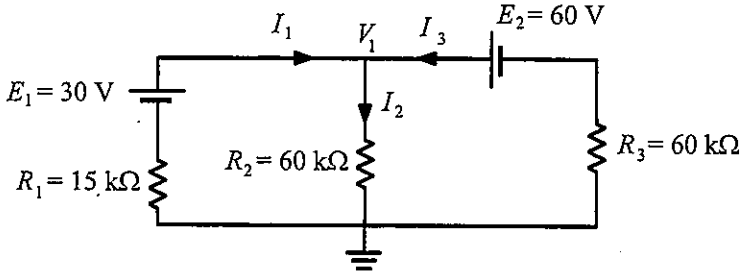

Figure Q2.3

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QUESTION 3 (25 MARKS)

a) Refer to **Figure Q3.1**. Given that $i_L(t) = 1.5 \sin(1260t + 60^\circ)$ A.

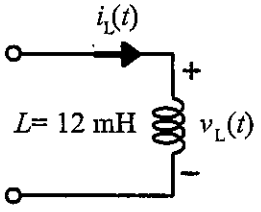

Figure Q3.1

i. Calculate $\mathbf{Z}_L$. (3 marks)

ii. Determine $v_L(t)$. (4 marks)

iii. Draw the phasor diagram of $\mathbf{V}_L$ and $\mathbf{I}_L$. (4 marks)

b) Refer to circuit in **Figure Q3.2**.

i. Calculate the total impedance, $\mathbf{Z}_T$. (9 marks)

ii. Determine $\mathbf{I}$. (2 marks)

iii. Use current divider to determine $\mathbf{I}_3$. (3 marks)

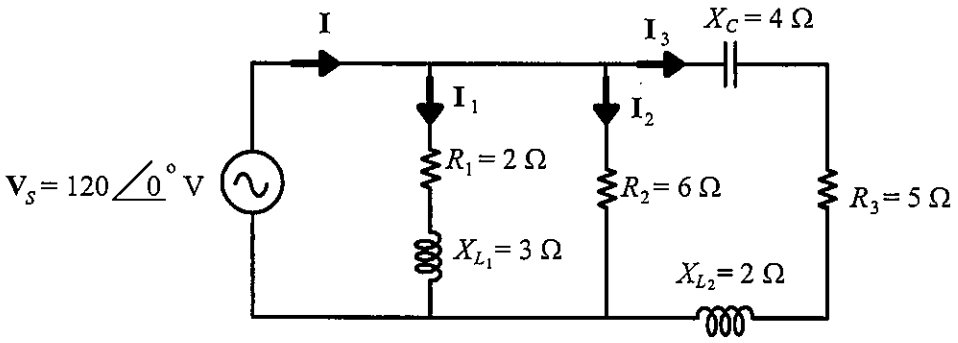

Figure Q3.2

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QUESTION 4 (25 MARKS)

a) **Figure Q4.1a** shows an *RL* circuit and its graph of i_L versus t is shown in **Figure Q41b**. Based on the figures, determine the values of R and L.

(6 marks)

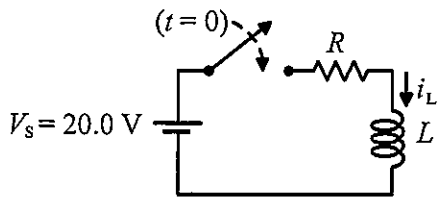

Figure Q4.1a

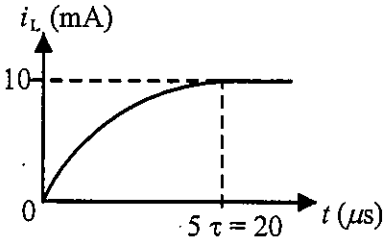

Figure Q4.1b

b) **Figure Q4.2** shows an *RL* decay circuit. Given that at $t = 0$ s, $i_L = 2$ A.

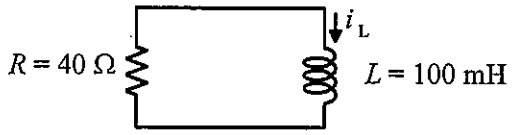

Figure Q4.2

i. Find the transient expression for i_L.

(3 marks)

ii. What is the value of i_L at $t = 500$ μs?

(2 marks)

iii. Determine the time taken for the current to fall to 10% of its initial value.

(4 marks)

c) The capacitor in **Figure Q4.3** is uncharged. The switch is then moved to position b at $t = 0$ s. Find:

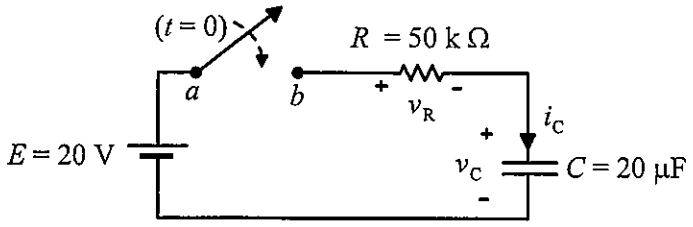

Figure Q4.3

i. The value of current at $t = 0$ s.

(2 marks)

ii. The time constant of the circuit.

(2 marks)

iii. The value of the i_C at $t = 1.5$ s.

(3 marks)

iv. The value of v_C at $t = 3.0$ s

(3 marks)

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